

**UROCTONITES, A NEW GENUS OF SCORPION FROM
WESTERN NORTH AMERICA
(SCORPIONES: VAEJOVIDAE)**

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Abstract. — A new genus of scorpion, *Uroctonites* Williams & Savary NEW GENUS, and a species, *Uroctonites giulianii* Williams & Savary NEW SPECIES, are named and described. The new species is found in the Inyo Mountains, White Mountains, and eastern Sierra Nevada of California, at elevations of 1370 to 3080 m. Three previously named species, *Vaejovis huachuca* (Gertsch & Soleglad), *Vaejovis montereus* (Gertsch & Soleglad), and *Vaejovis sequoia* (Gertsch & Soleglad), are assigned to *Uroctonites*. *Uroctonites* is known only from California and Arizona in the western United States of America.

Key Words. — Arachnida, Scorpiones, Vaejoidea, *Uroctonites*, systematics

In 1972, Gertsch and Soleglad revised the scorpion genus *Uroctonus* Thorell, which prior to 1972 included the single species *Uroctonus mordax* Thorell. They named 13 new species of *Uroctonus*, and concluded that *Uroctonus* was related to *Vaejovis*, with most characters assigned to *Uroctonus* intergrading with those of *Vaejovis*. No single character defined *Uroctonus*, so assignment of taxa to *Uroctonus* required an inconsistently applied combination of characters. The inexactness of generic definitions prompted subsequent workers to consider a number of the new *Uroctonus* species to belong to *Vaejovis* rather than to *Uroctonus* (Stahnke 1974; Williams 1976, 1980).

Our interest in the phylogenetic relationships among the *Uroctonus*-like scorpions was renewed by the collection of a series of scorpions from the Inyo Mountains of California during the mid 1970s. We conclude that these specimens represent an undescribed species that has a morphological similarity to *Uroctonus mordax*, but lacks a number of diagnostic characters uniquely shared by *U. mordax*, *Uroctonus franckei* Williams, and *Uroctonus grahami* Gertsch & Soleglad. They share with *Vaejovis huachuca* (*Uroctonus huachuca* Gertsch & Soleglad), *Vaejovis montereus* (*Uroctonus montereus* Gertsch & Soleglad), and *Vaejovis sequoia* (*Uroctonus sequoia* Gertsch & Soleglad) a unique arrangement of spiniform setae on the soles of the telotarsi, a character not found among other vaejoidea. We, therefore, propose that *V. huachuca*, *V. montereus*, *V. sequoia*, and the new species be assigned to a new genus. This new genus and the new species are named and described in this paper.

MATERIALS AND METHODS

Measurements cited are standard ones used in scorpion systematics, as defined by Williams (1980), unless otherwise noted. Color descriptions are as defined in Maerz and Paul (1930). Where morphometric data are characterized, means \pm

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one standard deviation, and sample size (n) are given. Trichobothrial notations conform to those of Gertsch and Soleglad (1972). In describing the keels of the pedipalp palm, the palm is viewed in natural orientation, as held by a resting scorpion. In this orientation, three keels are apparent on the dorsal surface. The middle keel is called the dorsal, the more lateral one is the retrodorsal, and the more medial one is called prodorsal. When the palm is viewed ventrally, three keels are apparent on the ventral surface. The middle keel (which may be obscure or absent) is called the ventral, the more lateral one is called the retroventral, and the more medial one is called the proventral keel. Between the prodorsal and proventral keels is an interior keel, the prolateral. Between the retrodorsal and retroventral keels is an exterior keel, the retrolateral. When morphometric measurements are taken from the palm, however, the palm is oriented differently with the fingers held in the vertical plane, and at right angles to this plane, the horizontal plane defines the axis for width measurements.

Specimens cited are deposited in the entomology collection of the California Academy of Sciences (CAS) in San Francisco unless otherwise indicated. Alternatively, they are in the University of California, Riverside (UCR); Essig Museum of Entomology, University of California, Berkeley (UCB); or the American Museum of Natural History, New York (AMNH).

TAXONOMY

Uroctonites Williams & Savary, NEW GENUS

Table 1, Figs. 1, 3–5, 7, 9–12, 13, 15–18

Uroctonus (in part): Gertsch & Soleglad 1972: 553, 557, 559, 561, 564–565 (key), 573–575, 589–592, Figs. 10, 36, 37, 64–67, 116–118, Tables 2, 5, 8; Stahnke 1974: 129, 130.

Vejoavis (in part): Stahnke 1974: 119 (key), 130, 132–136, Table 1.

Vaejoavis (in part): Williams 1976: 2, Table 1.

Type Species. — *Uroctonites giulianii* Williams & Savary, NEW SPECIES.

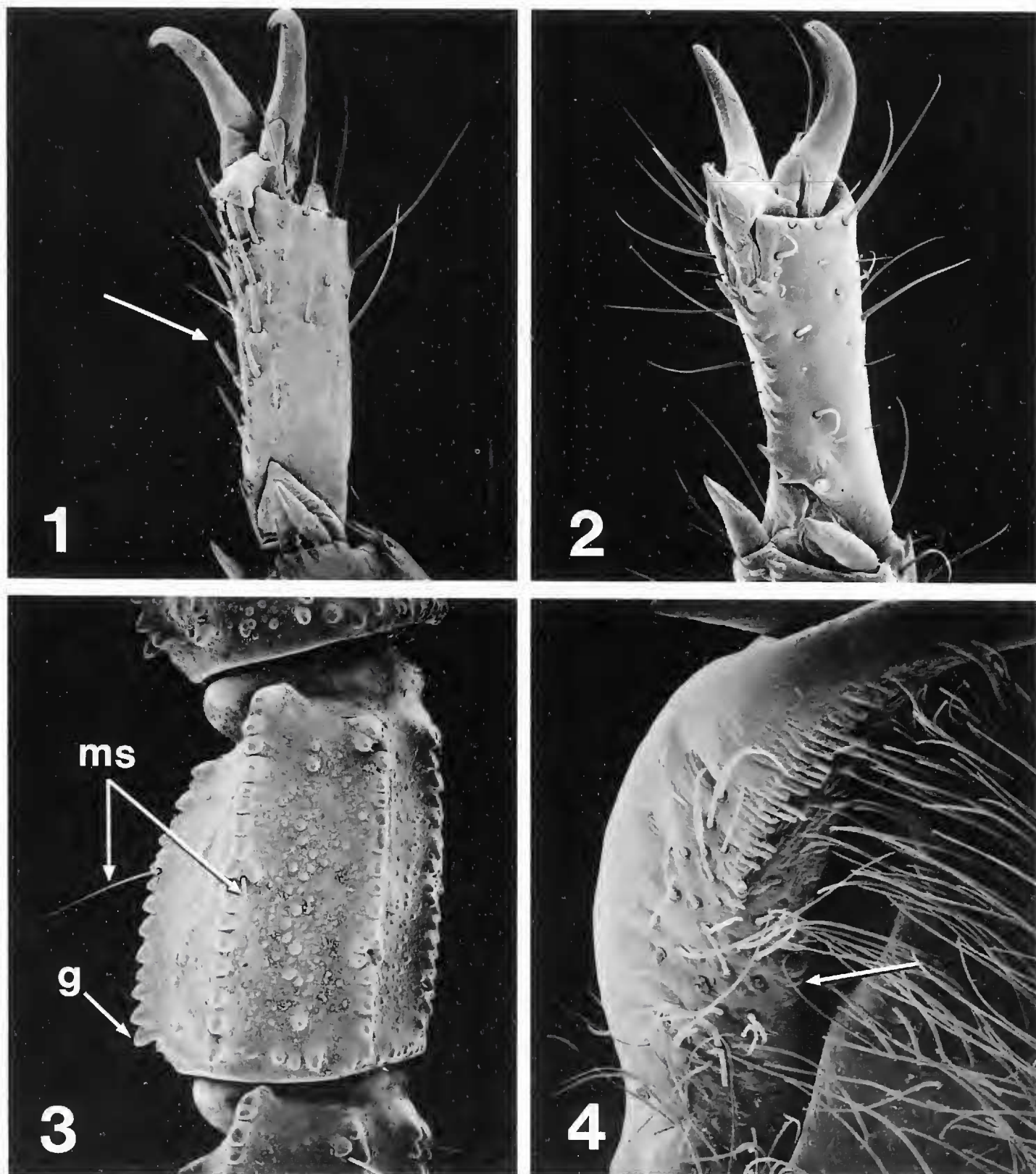
Description. — Prosoma: carapace frontal margin more or less bilobed; median ocelli relatively small, inconspicuous, on low tubercule; lateral ocelli two to three per group; sternum pentagonal, with deep posterior median depression. Mesosoma: terga I–VI lacking median and submedian keels, tergum VII with two pairs lateral keels, these not terminating in enlarged posterior denticle; sterna I–VI smooth, lacking keels; stigma small (carapace length/stigma length = 15–20), oval, length 2.0–3.0 × width; sternum VII lacking lateral keels; males with conspicuous genital papillae; hemispermatophore with lamellar hook basal, not adnate to lamella (Figs. 9–12), sclerotized mating plug reduced or absent. Pectine small, 7–12 teeth per comb; anterior lamella of three elongate sclerites, middle lamella with elongate basal sclerite and three to six subcircular sclerites; fulcra large, subtriangular, similar to adjacent middle lamellar sclerites in size or larger. Metasoma with dorsal, dorsolateral, ventral, and ventrolateral keels I–IV well developed and granular, dorsal and dorsolateral keels with angular termination, terminal denticle similar to adjacent denticles in elongation (Fig. 3); ventromedian keels paired on I–IV, on V single, not branched at terminus (Fig. 7). Chelicera with ventral margin of movable finger smooth to weakly crenulate (Fig. 4), superior tine of movable finger with one or two subdistal teeth, fixed finger with ventral surface lacking denticles. Pedipalp chela with palm swollen obliquely towards prodorsal keel, keels coarsely granular, intercarinal spaces granular dorsally, fixed finger with trichobothrium id near finger origin, trichobothrium eb2 slightly distal to finger origin, trichobothria pair eb1/eb2 not widely separated from trichobothria pair est/et (Fig. 13), supernumerary denticles six on fixed finger, six to seven on movable finger (Figs. 13, 15, 16), primary row denticles in five to six subrows on fixed finger, six subrows on movable finger; proventral keel of pedipalp chela terminating medially at movable finger base. Brachial trichobothria: two dorsals, 14 retrolaterals, two

Table 1. Measurements (in mm) of *Uroctonites giulianii* Williams & Savary NEW SPECIES, holotype and allotype. Abbreviations: aw = anterior width, d = depth, ditd = distal internal trichobothrium distance, ff = fixed finger, fmd = frontal margin distance, l = length, mf = movable finger, mw = median width, p-row = primary row denticles of chela, w = width.

Variables	Holotype (female)	Allotype (male)
Total length	36	35
Prosoma, carapace, (l/w)	4.2/3.8	3.9/3.2
Diad (l/w/fmd)	0.16/0.42/1.7	0.13/0.45/1.5
Sternum (l/aw/mw)	1.1/1.2/1.3	1.0/1.1/1.1
Metasoma, length	14.2	14.4
Segment I (l/w/d)	1.9/2.3/1.8	2.1/2.2/1.7
Segment II (l/w/d)	2.2/2.2/1.7	2.3/2.1/1.6
Segment III (l/w/d)	2.3/2.1/1.7	2.4/2.0/1.6
Segment IV (l/w/d)	3.0/2.0/1.6	2.9/1.8/1.6
Segment V (l/w/d)	4.8/2.0/1.6	4.7/1.7/1.5
Telson, length	4.7	4.6
Vesicle (l/w/d)	3.4/2.2/1.7	3.2/2.0/1.6
Aculeus (l)	1.4	1.4
Pedipalp, humerus (l/w)	3.8/1.3	3.4/1.2
Brachium (l/w)	3.9/1.3	3.4/1.4
Chela (l)	7.2	6.2
Palm (l/w/d)	4.4/2.3/3.2	3.9/2.3/3.2
Movable finger (l)	3.7	3.3
Fixed finger (l/ditd)	2.7/2.5	2.3/2.2
Supernumerary denticles (ff/mf)	6/6	6/6
Fixed finger p-row denticles	8-12-13-13-13-18	9-10-12-12-13-21
Movable finger p-row denticles	4-11-13-16-14-27	2-10-13-14-14-23
Pectine teeth (left/right)	7/8	8/8
Leg IV, patella (l/d)	3.4/0.95	2.9/0.9
Stigma III (l/w)	0.2/0.1	0.2/0.1

ventrals (Fig. 5), one prolateral. Humeral trichobothria: one dorsal, one retrolateral, no ventral, one prolateral. Legs with single ventromedian row of short spinules on telotarsus, this flanked pro- and retrolaterally by row of stout spiniform setae (Fig. 1).

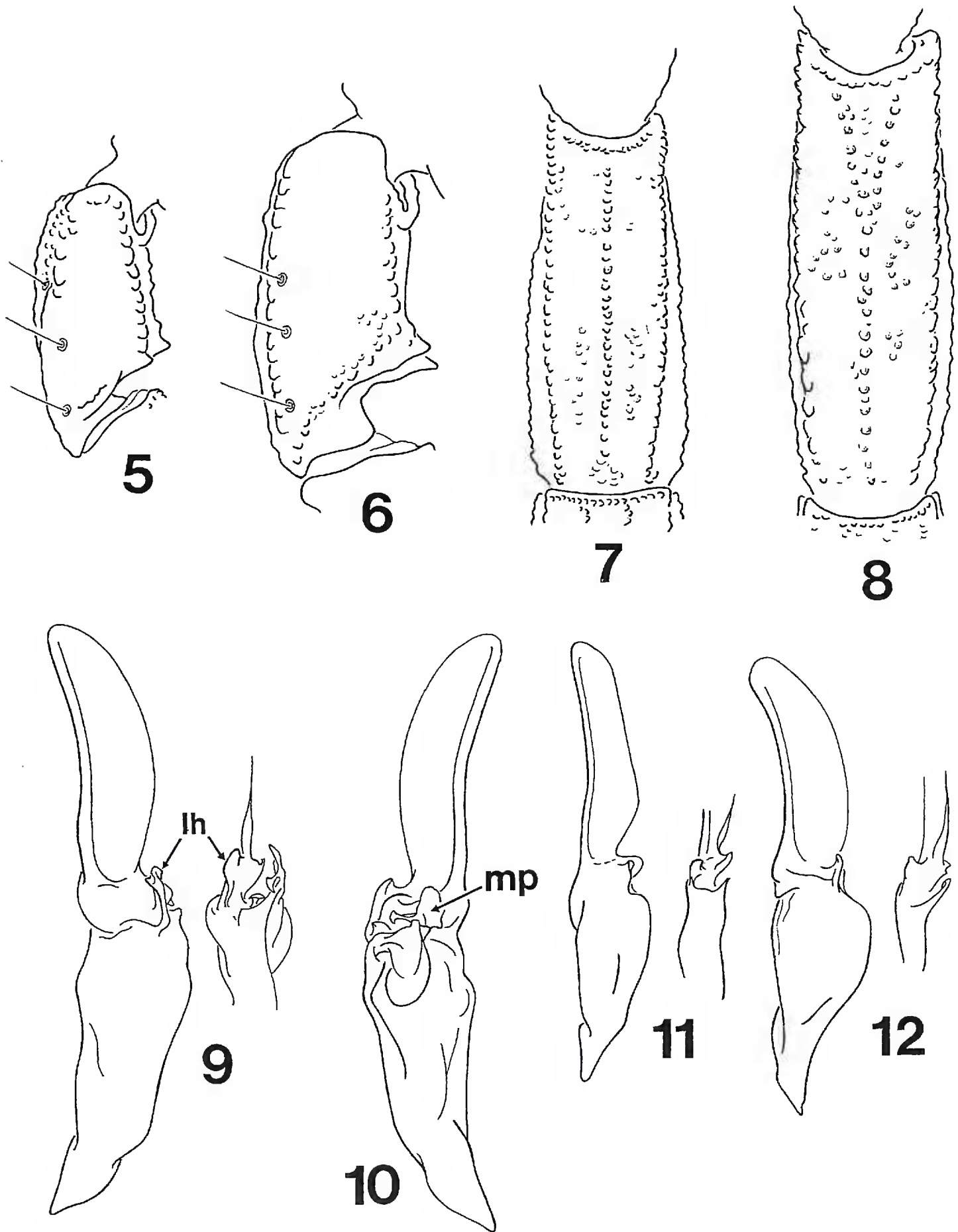
Diagnosis. — Members of this genus are distinguished from other vaejovids by the presence of a row of stout spiniform setae on each side of the ventromedian row of telotarsal spinulae (Fig. 1). Such spiniform setae are lacking in other vaejovids (Fig. 2). Members of *Uroctonites* are further distinguished from other vaejovids except *Uroctonus mordax*, *Uroctonus franckei*, *Uroctonus grahami*, and *Vaejovis lindsayi* by the absence of prolateral keels on the pedipalp brachium and by the reduction or loss of the sclerotized mating plug of the spermatophore (Fig. 10). They are further distinguished from members of *Uroctonus* by the lack of distinct denticles on the ventral margin of the movable finger of the chelicera (Fig. 4), by the presence of only two trichobothria on the ventral surface of the pedipalp brachium (Fig. 5), by the relative proximity of trichobothrial pairs et/est and eb1/eb2 (Fig. 13), and by the linear termination of the ventromedian keel of the fifth metasomal segment (Fig. 7). Members of *Uroctonus* bear denticles on the ventral margin of the movable finger of the chelicera, have three trichobothria on the ventral surface of the pedipalp brachium (Fig. 6), have trichobothrial pairs



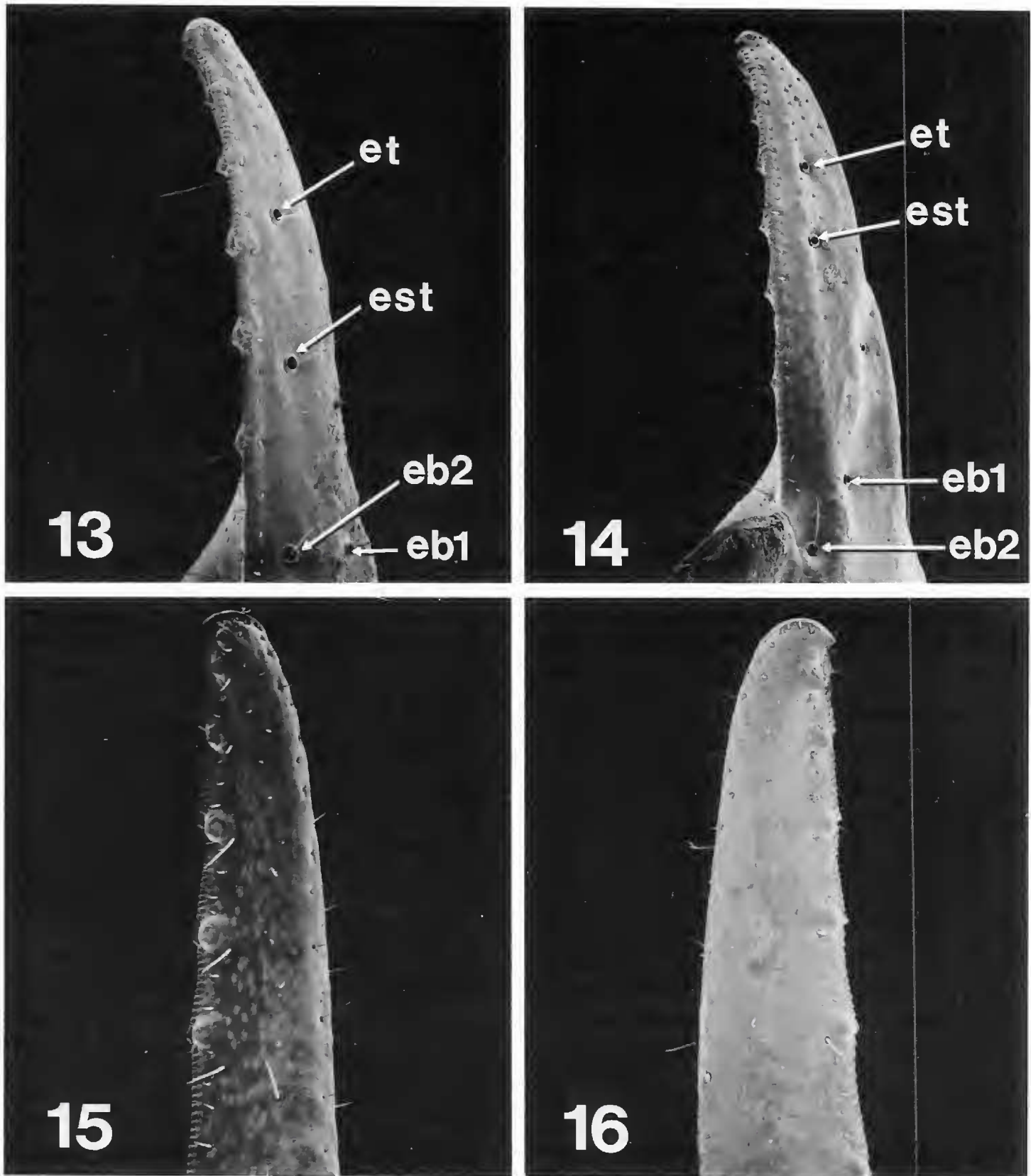
Figures 1–4. Morphological characters of *Uroctonus* and *Uroctonites*. Figure 1. *Uroctonites giulianii*, right telotarsus III, ventral aspect, showing arrangement of spiniform setae. Figure 2. *Uroctonus mordax*, right telotarsus III, ventral aspect, note lack of ventral rows of spiniform setae. Figure 3. *Uroctonites giulianii*, metasomal segment III, right lateral view, showing relative size of granules of dorsal and dorsolateral keels, note distal terminal granules (g) are similar to adjacent in size; macrosetae (ms) associated with dorsal and dorsolateral keels of metasoma III are shown. Figure 4. *Uroctonites giulianii*, right chelicera, ventral view, showing weak crenulations on the ventral margin of the movable finger. Illustrations in Figs. 1–4 are based on the following specimens: *Uroctonites giulianii*, adult male paratype from Waucoba Canyon, Inyo Mountains, Inyo County, California; *Uroctonus mordax*, adult male from Mount Diablo, Contra Costa County, California.

et/est and eb1/eb2 widely separated (Fig. 14), and have a Y-shaped caudal divergence of the ventromedian keel of the fifth metasomal segment (Fig. 8).

Taxa included in Uroctonites.—*Uroctonites montereus* (Gertsch & Soleglad, 1972); *Uroctonites sequoia* (Gertsch & Soleglad, 1972), *Uroctonites huachuca*



Figures 5–12. Morphological characters of *Uroctonites* and *Uroctonus* species. Figure 5. *Uroctonites montereus*, right pedipalp brachium, ventral aspect, showing characteristic two ventral trichobothria. Figure 6. *Uroctonus mordax*, right pedipalp brachium, ventral aspect, showing characteristic three ventral trichobothria. Figure 7. *Uroctonites montereus*, metasomal segment V, ventral aspect, showing linear termination of ventromedian keel caudally. Figure 8. *Uroctonus mordax* metasomal segment V, ventral aspect, showing “Y”-shaped divergence of ventromedian keel caudally. Figure 9. *Uroctonites montereus*, right hemispermatothore, external view, lamellar hook (lh) is indicated. Figure 10. *Uroctonites montereus*, right hemispermatothore, internal view, sclerotized mating plug indicated (mp). Figure 11. *Uroctonites giulianii*, right hemispermatothore, external view. Figure 12. *Uroctonites huachuca*, right hemispermatothore, external view. Illustrations in Figs. 5–12 are based on the following specimens: *Uroctonites giulianii*, adult male, paratype from Waucoba Canyon, Inyo Mountains, Inyo County, California; *Uroctonites montereus*, adult male, from Monterey, Monterey County, California; *Uroctonites huachuca*, male, Huachuca Mountains, Cochise County, Arizona.

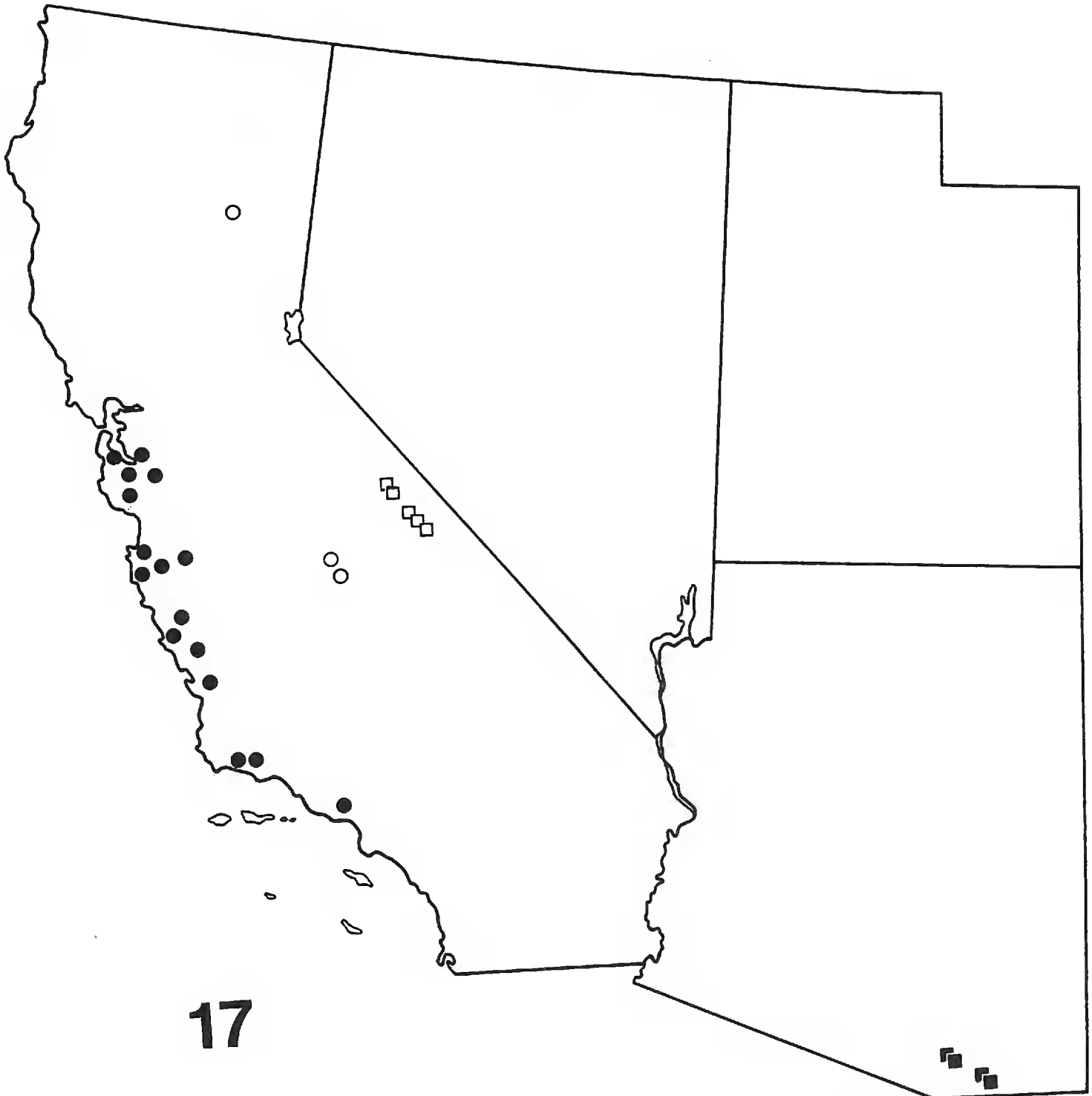


Figures 13–16. Morphological characters of *Uroctonus* and *Uroctonites* species. Figure 13. *Uroctonites giulianii*, pedipalp fixed finger, retrolateral aspect, showing presence of six supernumerary granules; positions of trichobothria et, est, eb1, and eb2 are indicated. Figure 14. *Uroctonus mordax*, pedipalp fixed finger, retrolateral aspect, showing presence of seven supernumerary granules and wide separation of trichobothria pairs et/est and eb1/eb2. Figure 15. *Uroctonites giulianii*, pedipalp movable finger, prolateral aspect, showing presence of six supernumerary granules. Figure 16. *Uroctonites montereus*, pedipalp movable finger, prolateral aspect, showing presence of seven supernumerary granules. Figures 13–16 are based on the same specimens as cited for Figs. 1–4.

(Gertsch & Soleglad, 1972); *Uroctonites giulianii* Williams & Savary, NEW SPECIES.

Distribution.—Southern Arizona to coastal California (Fig. 17).

Remarks.—The name *Uroctonites* combines the name *Uroctonus* with the suffix “-ites,” which suggests relationship with *Uroctonus*. Members of this genus are



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Figure 17. Distribution of *Uroctonites montereus* (solid circles), *Uroctonites sequoia* (open circles), *Uroctonites huachuca* (solid squares), and *Uroctonites giulianii* new species (open squares).

found on exposed rock surfaces and talus slopes and under rocks in xeric, montane, cave, and coastal environments. Their occurrence as geographically isolated species with restricted ranges suggests they are relicts of a previously more broadly distributed lineage. Of the four known species, all appear to reside in small, isolated populations, except for the more broadly distributed *U. montereus*.

Uroctonites giulianii Williams & Savary, NEW SPECIES

Table 1, Figs. 1, 3, 4, 11, 13, 15–19

Types.—Holotype, female, deposited in the California Academy of Sciences (CAS Type No. 16436), data: USA. CALIFORNIA. *INYO Co.*: White Mountains, Inyo National Forest, Ancient Bristlecone Pine Forest, 1.1 km (0.7 mi) S of Schulman Grove, el. 3080 m, 4 Sep 1988, S. C. Williams, V. F. Lee. Allotype, male, deposited in the California Academy of Sciences (CAS Type No. 16436), data: USA. CALIFORNIA. *INYO Co.*: Inyo Mountains, Lead Canyon, el. 1951



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Figures 18–19. *Uroctonites giulianii* Williams & Savary, NEW SPECIES, paratype, female, from Addie Canyon, Inyo Mountains, Inyo County, California.

m, 18 May 1976, D. Giuliani. Paratypes: USA. CALIFORNIA. *INYO Co.*: (Inyo Mountains): Addie Canyon, el. 2160 m, 5 Aug 1975, D. Giuliani, 1 female; Addie Canyon, el. 2130 m, 20 May 1976, D. Giuliani, 2 females, 3 juveniles; Addie Canyon, el. 2130 m, 8 May 1974, L. LaPre, S. Mifras, 1 female (UCR); Beveridge Canyon, el. 2000 m, 4 Jul 1975, D. Giuliani, 2 males, 1 juvenile; Beveridge Canyon, el. 2900 m, Jul 1975, D. Giuliani, 1 male; Lead Canyon, el. 1950 m, 18 May 1976, D. Giuliani, 1 male, 2 females, 1 juvenile; Lead Canyon, el. 1980 m, under rock, 11 Apr 1974, L. LaPre, M. Eells, 1 juvenile male (UCR); ridge N of Lead Canyon, el. 2134 m, Dec 1980, D. Howell, 1 female; 11.3 km (7 mi) N and 4.8 km (3 mi) E of Lone Pine, el. 1829 m, 14 Apr 1989, D. Giuliani, 1 male; Waucoba Canyon, el. 1980-2290 m, 9 Jun 1976, D. Giuliani, 2 males, 1 juvenile; Willow Creek, el. 1370 m, 16 Sep 1976, D. Giuliani, 3 females; White Mountains: 0.2 km (0.1 mi) NE of Batchelder Spring, 8.8 km (5.5 mi) N of and 8.8 km (5.5 mi) E of Big Pine, el. 1860 m, 28 Aug 1984 to 11 Jun 1985, D. Giuliani, alcohol/antifreeze pitfall, 1 male; The Narrows, 16.1 km (10 mi) NE of junction of state Highways 395 and 168 on Highway 168, el. 2100 m, 13 Aug 1988, W. E. Savary, R. Jackson, 1 male; 0.2 km (0.1 mi) NE of Batchelder Spring, 8.8 km (5.5 mi) N of and 8.8 km (5.5 mi) E of Big Pine, el. 1860 m, 1 Oct 1985 to 28 Jun 1986, D. Giuliani, alcohol/antifreeze pitfall, 1 male; Ancient Bristlecone Pine Forest, 1.1 km (0.7 mi) S of Schulman Grove, el. 3080 m, 4 Sep 1988, S. C. Williams, V. F. Lee, female; 1.8 km (1.2 mi) S of Schulman Grove, el. 2930 m, 4 Sep 1988, S. C. Williams, V. F. Lee, 3 females, 1 juvenile; (Sierra Nevada): Shannon Canyon, 4.8 km (3 mi) N and 8.0 km (5 mi) W Big Pine, el. 2042 m, 9 Jun 1988, D. Giuliani, 1 male. *MONO Co.*: White Mountains, Marble Canyon, 16.1 km (10 mi) NNE of Big Pine, el. 2041 m, 9 Jun 1988, D. Giuliani, 1 male.

Description.—Female (Holotype). Coloration: dorsum of carapace, metasoma, and pedipalps moderate burnt umber, carapace with slight brown marbling, mesosoma slightly lighter, keels of pedipalps and metasoma contrastingly darker brown than background cuticle; walking legs slightly paler than mesosoma, more yellow; vesicle slightly yellow; pedipalp palms amber brown, keels and fingers contrastingly darker brown; venter white-yellow, similar to legs; pectines slightly white. Prosoma: anterior carapace margin deeply bilobed, with three pairs of frontal setae; carapace lacking distinct keels, finely granular, granules homogeneous, posterior median groove deep; median ocelli small, on low, inconspicuous ocular tubercle, ocelli separated by more than 1.2 ocellar diameters; three lateral ocelli per group; sternum pentagonal, with broad posterior median depression, four pairs of sternal macrosetae. Mesosoma: terga I–VI lacking keels, finely granular, granules homogeneous; tergum VII lacking median keel, with two pairs of serrated lateral keels that do not terminate in an enlarged posterior denticle; sterna I–VI smooth, lacking keels; stigma small, oval, length to width ratio 2.1, sternum VII with about 12 irregular posterior granules; 10 pairs of genital macrosetae, variable in length; Pectine: Three sclerites in marginal lamella, one proximal angular sclerite plus three irregular sclerites in middle lamella, large subtriangular fulcra, with fulcra similar to or slightly larger than adjacent sclerites of middle lamella, most fulcra lacking macrosetae, distal tooth laterally swollen, 2.0× wider than adjacent teeth. Metasoma: dorsal and dorsolateral keels I–IV coarsely granular, with angular termination, terminal denticle similar to adjacent ones in size (Fig. 3); ventral and ventrolateral keels raised, coarsely granular, homogeneously developed on I–IV, ventromedian V single, not branched at terminus, dorsal keels with 0-1-1-1 pairs of macrosetae on segments I–IV, dorsolateral keels with 0-1-1-1 pairs of macrosetae on segments I–IV. Telson: vesicle smooth, lustrous, seven to eight pairs of macrosetae ventrally, Chelicerae: ventral margin of movable finger with three to four crenulations (Fig. 4), ventral surface of fixed finger lacking denticles; movable finger with two subdistal teeth on dorsal tine. Pedipalps: palm swollen obliquely, with heavy granular keels. Ventral surface of palm broad and flat; internal surface of fingers with narrow space proximally between fingers when chela closed; dorsal, prodorsal, and retrodorsal keels distinct and coarsely granular, ventral keel obsolete to obscure; retrolateral, prolateral, retroventral, and proventral keels distinct and broadly granular; proventral keel terminating medially at movable finger base; palm swollen toward prodorsal keel. Brachial macrosetae: two dorsals, five retrolaterals, one ventral, four prolaterals. Humeral macrosetae: three dorsals, nine retrolaterals, four ventrals, four prolaterals. Leg III: telotarsi each with 15–17 fine spinules in single ventromedian row, this row flanked by a prolateral and retrolateral row of three to five stout spiniform macrosetae (Fig. 1).

Male.—(Allotype). Similar to female (holotype) in color and structure except: smaller body size; large genital papillae present; metasoma slightly more slender; dorsal keel with 0-0-1-1 pairs of macrosetae; pedipalp palm more swollen.

Variation.—Paratypes similar to holotype and allotype in size, color, and structure with following exceptions: total length 20–36 mm in males, 27–40 mm in females; pectine tooth counts eight to nine in males, seven to eight in females; one female with one subdistal tooth on dorsal tine of each movable cheliceral finger, one female with one subdistal tooth on one side and two on the other side; smaller individuals lighter in coloration than larger ones; several specimens light tan in general coloration. Several specimens with lateral ocelli reduced to two per group.

Diagnosis.—Characters that distinguish *U. giulianii* are: total length up to 40 mm; base color of body burnt umber to light tan, keels of metasoma and pedipalps often contrastingly darker than surrounding cuticle; median ocelli small, ratio of carapace width to diameter of diad 6.6–9.4 ($\bar{x} = 8.0 \pm 0.7$, $n = 14$); chelicera with several small crenulations on ventral margin of movable finger (Fig. 4), superior tine of movable finger with two (rarely with one) subdistal teeth; pedipalp palm swollen obliquely toward prodorsal keel, ratio of chela length to palm width 2.7–3.4 ($\bar{x} = 3.0 \pm 0.2$, $n = 14$), ratio of palm width to depth 0.7–0.8 ($\bar{x} = 0.8 \pm 0.04$, $n = 14$); fixed finger of chela with trichobothrium on palm near finger origin, supernumerary denticles six on fixed and movable fingers (Figs. 13, 15), primary row denticles divided into six linear subrows on fixed and movable fingers; pectine teeth eight to nine in males, seven to eight in females.

This species is related to *U. huachuca* in structure and coloration, but differs

as follows: metasoma with dorsal keel macrosetal formula 0-0-1-1 or 0-1-1-1 on segments I-IV (not 0-0-0-0 or 0-0-0-1); aculeus shorter, ratio of vesicle length to aculeus length greater than 1.9 ($\bar{x} = 2.2 \pm 0.1$, $n = 14$).

Distribution.—White Mountains, Inyo Mountains, and eastern Sierra Nevada of California from 1370–3080 m elevation (Fig. 17).

Remarks.—Variable in coloration, adult size, and morphology. This and *Paruroctonus boreus* (Girard) are the only scorpions known to inhabit the Ancient Bristlecone Pine Forest. These two species are found at elevations higher than any other scorpion in North America. In the bristlecone pine forest, the environmental conditions probably restrict normal foraging and growing conditions to no more than three to four months of the year. The concurrence of light tan forms and a distinctly melanic form suggests a life cycle that may be longer than one year. It has been collected under rocks and from exposed rocky surfaces at night by ultraviolet detection. This species is named after Derham Giuliani, a resident of Big Pine, California, in recognition of his significant collections of desert scorpions and contributions to our knowledge of desert biology.

Material Examined.—See types.

Uroctonites montereus (Gertsch & Soleglad), NEW COMBINATION
Figs. 5, 7, 9, 16, 17

Uroctonus montereus Gertsch & Soleglad 1972: 565, 583, 589–591.

Vejovis montereus (Gertsch & Soleglad): Stahnke 1974: 130, 136, Table 1.

Vaejovis montereus (Gertsch & Soleglad): Williams 1976: 2.

Types.—Holotype, female, deposited in the American Museum of Natural History, data: USA. CALIFORNIA. MONTEREY Co.: Hastings Natural History Reservation, Red Hill, 3 Feb 1951, J. Linsdale.

Diagnosis.—Characters that distinguish *U. montereus* are: total length up to 40 mm; base color of body dark fuscous brown to light tan, keels of metasoma and pedipalps often contrastingly darker than surrounding cuticle; frontal margin of carapace deeply bilobed, median ocelli small, ratio of carapace width to diameter of diad 6.0–8.3 ($\bar{x} = 7.0 \pm 0.6$, $n = 30$); chelicera lacking crenulations on ventral margin of movable finger, superior tine of movable finger with one (rarely two) subdistal tooth; pedipalps with palm swollen obliquely toward prodorsal keel, ratio of chela length to palm width 2.6–3.1 ($\bar{x} = 2.9 \pm 0.1$, $n = 30$), ratio of palm width to depth 0.6–0.8 ($\bar{x} = 0.7 \pm 0.05$, $n = 30$); supernumerary denticles six on fixed finger, seven on movable finger (Fig. 16), primary row denticles in six subrows on fixed and movable fingers; telotarsi with single row of fine spinulae ventrally, this flanked pro- and retrolaterally by a row of four stout spiniform setae; pectine teeth 10–12 in males, 8–10 in females.

This species is related to *U. sequoia* in structure, but differs in having primary row denticles of fixed pedipalp finger divided into six (not five) subrows.

Distribution.—California: Alameda and San Mateo counties—south to Los Angeles County, from sea level to 700 m elevation (Fig. 17).

Remarks.—This is the most broadly distributed and frequently encountered member of the genus, but it is never locally abundant. It can be encountered throughout the year by turning rocks and other ground surface debris. Females with associated litters were recorded from the Monterey area from July and

December. Litters ranged in size from 21–50 offspring ($\bar{x} = 34 \pm 11$, $n = 5$). One specimen in the CAS collection has a Sedona, Coconino County, Arizona locality label but is probably incorrectly labeled because there is no other evidence that this species ranges east of coastal California.

Material Examined.—USA. CALIFORNIA. ALAMEDA Co.: approx. 1.6 km (1 mi) S of Niles district, Fremont, Kimber Farms Chicken Ranch, open, grassy, SW facing hillside along roadcut, el. 76 m, 11 Jan 1970, J. Hjelle, T. Glimme, F. Koehler, F. Salazar, 1 male. LOS ANGELES Co.: Canoga Park, el. 500 m, 7 Apr 1969, P. McLynn, 1 female. MONTEREY Co.: Monterey (all collected by R. Johnson): 28 Jan 1963, 1 male, 25 Feb 1963, 1 female, 18 Mar 1963, 1 female, 22 Mar 1966, 1 male, 1 juvenile, 30 Apr 1965, 1 female, 22 May 1961, under chalk rock, 1 female, 27 May 1963, 1 male, 2 females, 30 May 1970, 1 female with 32 offspring, 1 female with 21 offspring, 1 female with 38 offspring (labeled “eggs 7/21/1970”), 17 Jun 1963, 2 females, 26 Jun 1967, 3 males, 2 females, 2 juveniles, 2 Aug 1963, 3 males, 3 females, 2 juveniles, 2 Aug 1963, 1 female with 50 offspring, 5 Aug 1963, 2 males, 4 females, 16 Aug 1970, 3 females, 1 juvenile, 26 Oct 1962, beneath chalk rock, 1 male, 8 Nov 1970, 1 female; 15 Nov 1962, 1 female, 19 Nov 1962, 1 female, 21 Nov 1962, 1 female, 24 Dec 1969, 1 female with 31 offspring; approx. 1.6 km (1 mi) S of Monterey, 2 Apr 1972, R. Johnson, 1 male, 1 female; woods near Monterey Peninsula College, approximately 1.6 km (1 mi) from Monterey, 30 Apr 1965, R. Johnson, 1 male, 4 females; 1.6 km (2 mi) from Monterey, R. Johnson, 24 Feb 1961, under rock, 1 female, 10 Jul 1961, 1 female, 22 May 1961, under chalk rock, 1 female; Palo Colorado Canyon: 19 Jul 1963, R. Johnson, 1 female; 22 Jul 1963, R. Johnson, male; 30 Jul 1963, R. Johnson, 1 male, 1 juvenile; Pena Blanca Lake, 30 May 1971, G. Bowden, 1 female; La Gloria Rd., 16.1 km (10 mi) from Gonzales, 22 Jun 1963, R. Johnson, 1 male; Hastings Natural History Reserve nr Jamesburg, 16 Mar 1957, J. Powell, 1 female (UCB). SAN BENITO Co.: La Gloria Rd, 13 May 1963, R. Johnson, 1 male. SAN LUIS OBISPO Co.: 3.7 km (2.3 mi) NE of San Luis Obispo along Stenner Creek Road, 15 Jul 1974, R. Haradon, V. Lee, W. Savary, 1 male; 19.3 km (12 mi) W of State Highway 101 on State Highway 46, el. 400 m, 13 Feb 1987, T. Briggs, V. Lee, 1 female; 3.9 km (2.4 mi) NW of road to Hearst San Simeon State Historical Monument on State Highway 1, el. 60 m, 13 Feb 1987, T. Briggs, V. Lee, 1 female; 2.9 km (1.8 mi) NW of San Luis Obispo on Stenner Creek Road on underside of serpentine rock in grassland, 26 Feb 1967, V. Lee, 1 juvenile. SAN MATEO Co.: Crystal Springs Lake, under stones, 18 Oct 1920, C. Duncan, 1 female, 1 male; 1.3 km (0.75 mi) N of Crystal Springs Dam on County Road 14, under rock near spring, 26 Feb 1966, K. Hom, 3 males, 1 female, 2 juveniles; Edgewood County Park, along Serpentine Trail, el. 210 m, 2 Jan 1987, T. Briggs, V. Lee, D. Ubick; Jasper Ridge (date and collector unknown), 1 male. SANTA BARBARA Co.: About 3.2 km (2 mi) N of Gaviota Beach State Park, 26 Dec 1966, T. S. Briggs, 1 female; E of San Marcos Pass, el. 680 m, 16 Jun 1956, Coll. PBS [probably P. S. Bartholomew], 1 female. SANTA CLARA Co.: Montebello Ridge, short grass on gravel, 25 Jun 1965, D. Kavanaugh, 1 male; Alum Rock Park, 12 Sep 1977, J. Hjelle, J. Ramsey, 1 male. SANTA CRUZ Co.: Castle Rock, 17 Jul 1971, G. Burden, 1 male.

Uroctonites huachuca (Gertsch & Soleglad), NEW COMBINATION

Figs. 12, 17

Uroctonus huachuca Gertsch & Soleglad 1972: 565, 573–576.

Uroctonus? huachuca Stahnke 1974: 130.

Type.—Holotype, female, deposited in the American Museum of Natural History, data: USA. ARIZONA. SANTA CRUZ Co.: Santa Rita Mountains, Madera Canyon, 7 Jun 1952, W. J. Gertsch.

Diagnosis.—This species is related to *U. giulianii* in structure and coloration, but differs as follows: metasoma with dorsal keel macrosetal formula 0-0-0-0 or 0-0-0-1 (not 0-0-1-1 or 0-1-1-1) on segments I–IV; aculeus longer, ratio of vesicle length to aculeus length less than 1.9 ($\bar{x} = 1.7 \pm 0.1$, $n = 8$).

Distribution.—Santa Rita and Huachuca Mountains of Arizona, from 1600–2440 m elevation (Fig. 17).

Remarks.—*Uroctonites huachuca* is found in limestone cave and surface environments, but no evidence of unique cave adaptations is apparent. Observations by Bill Peachey, an Arizona speleologist, suggest a permanent population inhabits Hidden Cave in Santa Cruz County, Arizona. This is the first cave record for this species.

Material Examined.—USA. ARIZONA. COCHISE Co.: Huachuca Mountains, Reef Road terminus, el. 2439 m, 20 Aug 1967, 2 females, 3 juveniles; Huachuca Mountains, Carr Canyon, 16 Aug 1969, R. Haradon, 2 females. SANTA CRUZ Co.: Santa Rita Mountains, Gardner Canyon, Hidden Cave, el. 1616 m, 24 Jun 1988, W. E. Savary, T. S. Briggs, D. Ubick, W. Rauscher, in dark zone, 2 males, 2 juveniles.

Uroctonites sequoia (Gertsch & Soleglad), NEW COMBINATION

Fig. 17

Uroctonus sequoia Gertsch & Soleglad 1972: 565, 590–592.

Vejovis sequoia (Gertsch & Soleglad): Stahnke 1974: 130, 136.

Vaejovis sequoia (Gertsch & Soleglad): Williams 1976: 2.

Type.—Holotype, female, deposited in the American Museum of Natural History, data: USA. CALIFORNIA. TULARE Co.: Sequoia National Park, Clough Cave, under rocks in Ladder Room, 14 May 1966, T. S. Briggs.

Diagnosis.—This species is related to *U. montereus*, but has primary-row denticles of fixed pedipalp finger divided into five (not six) subrows.

Distribution.—Sierra Nevada of California from Plumas and Tulare counties from elevations of 900–1500 m (Fig. 17).

Remarks.—This is one of the rarest species of scorpion in California, being known only from seven specimens, of which only four are adults. A young male specimen from Clough Cave, listed by Gertsch & Soleglad (1972) has three small lateral eyes on each side of the carapace, as do the three specimens from near Hammond. A single juvenile female from near Quincy has two eyes on the left side of the carapace and three on the right.

Material Examined.—USA. CALIFORNIA: PLUMAS Co.: Soda Springs Cave area, 16.1 km (10 mi) N of Quincy, 5 Sep 1961, W. J. Gertsch, W. Ivie, 1 juvenile (AMNH). TULARE Co.: 19.3 km (12 mi) NE of Hammond, 21 Mar 1941, S. & D. Mulaik, 2 males, 1 female (AMNH); Sequoia National Park, Clough Cave, 26 Nov 1965, V. Lee, 1 juvenile male.

Key to Species of *Uroctonites*

1. Movable cheliceral finger with dorsal tine bearing one (rarely two) subdistal tooth; seven supernumerary denticles on pedipalp movable finger. (Fig. 16) 2
- Movable cheliceral finger with dorsal tine bearing two (rarely one) subdistal teeth; six supernumerary denticles on pedipalp movable finger. (Fig. 15) 3
- 2(1). Pedipalp fixed finger with primary row denticles in five subrows. (Sierra Nevada, California) *U. sequoia*
- Pedipalp fixed finger with primary row denticles in six subrows. (coastal central and southern California) *U. montereus*
- 3(1). Metasoma with dorsal keel macrosetal formula 0-0-0-0 or 0-0-0-1 on segments I–IV; aculeus elongate, ratio of vesicle length to aculeus length less than 1.9. (southern Arizona) *U. huachuca*

- Metasoma with dorsal keel macrosetal formula 0-0-1-1 or 0-1-1-1 on segments I–IV; aculeus short, ratio of vesicle length to aculeus length greater than 1.9. (Inyo Mountains, White Mountains and Sierra Nevada of southeastern California) *U. guilianii*

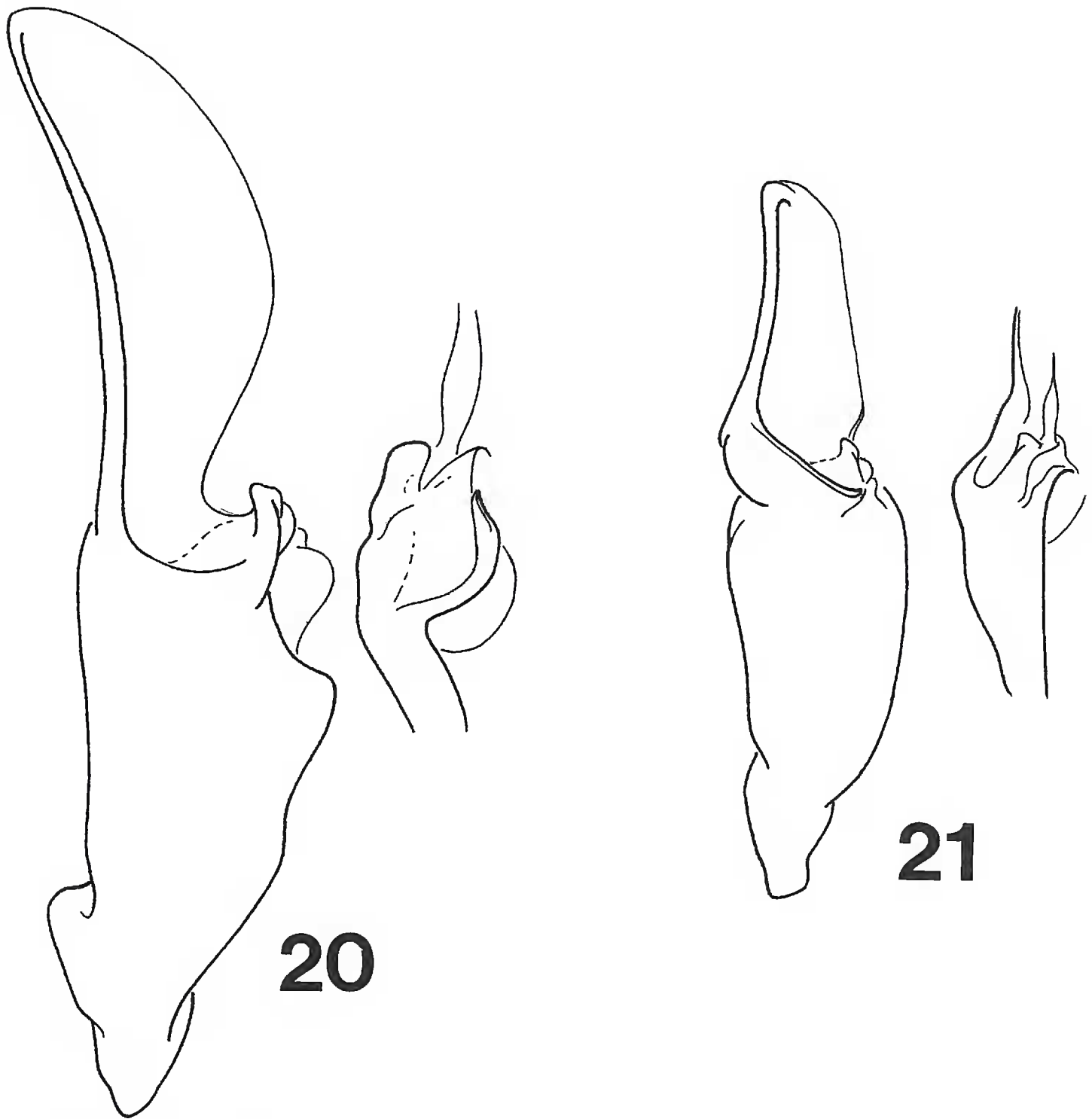
DISCUSSION AND CONCLUSIONS

Phylogenetic Relationships.—Our hypothesis of common ancestry for *Uroctonites*, *Uroctonus*, and *Vaejovis lindsayi* is supported by their shared absence of prolateral keels on the pedipalp brachium, the suppression of the ventral keel on the pedipalp chela, and by the reduction or loss of the sclerotized mating plug of the spermatophore. These character states are regarded as synapomorphies. *Vaejovis lindsayi* lacks the additional synapomorphies that currently define *Uroctonus* or *Uroctonites* and, thus, should not be assigned to either of these genera at this time. Transfer of *V. lindsayi* to its own monotypic genus is a possible solution for systematic placement, but this would appear to erect a genus defined solely on plesiomorphic character states. We, therefore, prefer to treat this enigmatic relic as an “incertae sedis” within the *Uroctonus/Uroctonites* lineage.

We conclude that the genus *Uroctonus* is currently composed of only three species: *U. mordax*, *U. franckei* and *U. grahami*. We also conclude that *Uroctonites* is currently composed of only four species: *U. guilianii*, *U. huachuca*, *U. montereus*, and *U. sequoia*. We further conclude that the remaining species that have previously been associated with *Uroctonus* belong to a subgroup of *Vaejovis* that we refer to as the *minimus* group. Placement into the *minimus* group is done largely on the basis of spermatophore characters (Figs. 22–29). The *minimus* subgroup includes the following taxa: *Vaejovis andreas*, *Vaejovis angelenus*, *Vaejovis apacheanus*, *Vaejovis bogerti*, *Vaejovis chicano*, *Vaejovis glimmei*, *Vaejovis iviei*, *Vaejovis minimus*, *Vaejovis montcazieri*, *Vaejovis rufulus*, and *Vaejovis williamsi*. Members of this group share with *Serradigitus*, *Syntropis* and other *Vaejovis* subgroups, spermatophores that have elevated lamellar hooks that are adnate to the lamella (Figs. 22–29). The shared possession of this character state is regarded as synapomorphic, and contrasts with the basal positioning of the lamellar hooks in species of *Uroctonites* and *Uroctonus* and in *Vaejovis lindsayi* (Figs. 9–12, 20–21). A second synapomorphy, the longitudinal orientation of the larvae on the dorsum of the female following parturition, supports this association of the *minimus* group with *Serradigitus*, *Syntropis*, and other *Vaejovis* (Savary, unpublished data).

Suppression of the ventral keel of the pedipalp chela and reduction (but never the complete loss) of the prolateral keels of the pedipalp brachium occur in the *minimus* group. This reduced keel configuration would tend to suggest a similarity between the *minimus* group members of *Vaejovis*, and *Uroctonus* but this similarity appears homoplastic.

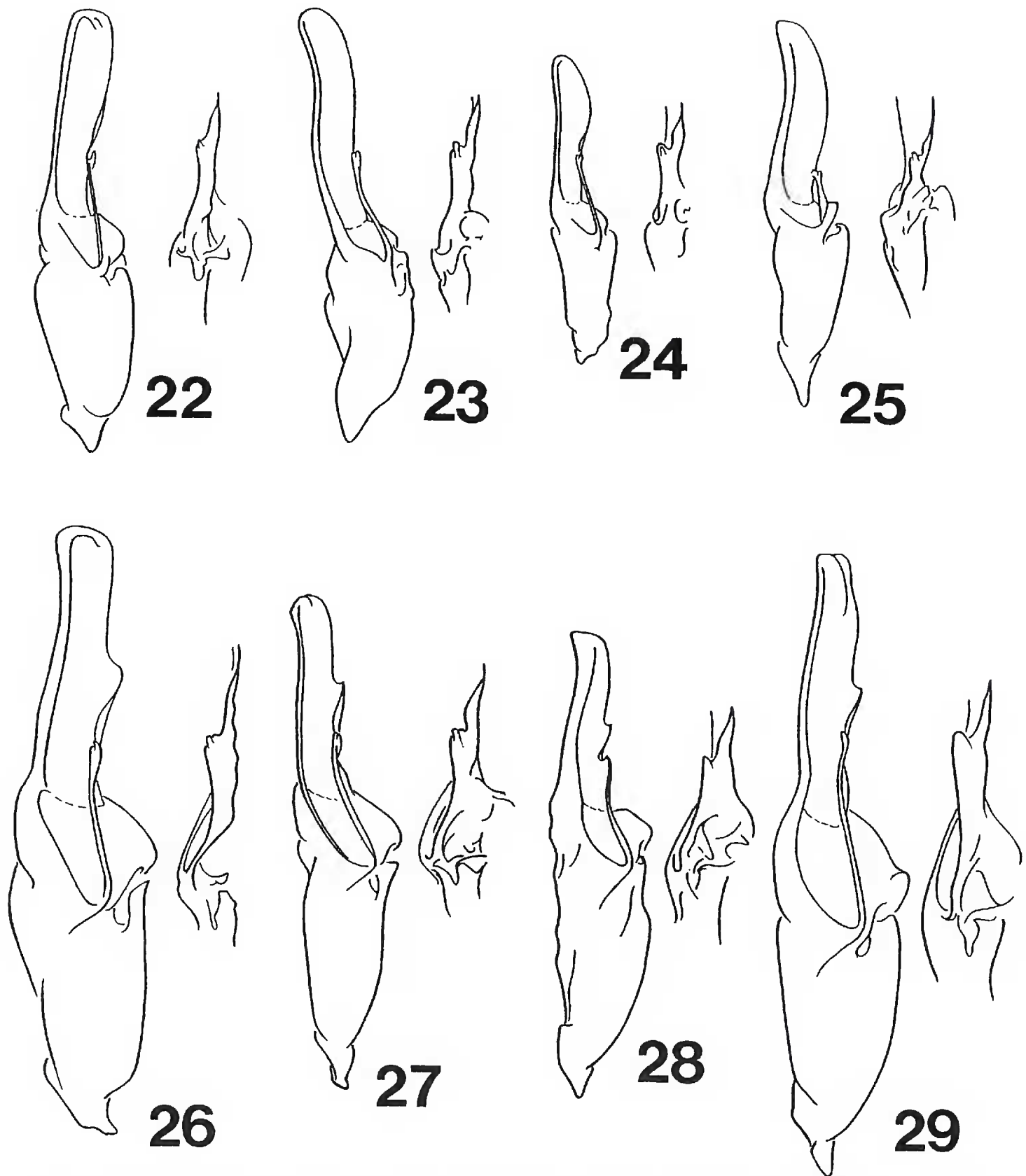
Distribution Patterns.—The members of *Uroctonites* are distributed as two species pairs, which are separated from one another by the intervening crest of the Sierra Nevada. To the west of the Sierra Nevada crest the sister species *U. montereus* and *U. sequoia* occur. Both have a single subdistal tooth (rarely two) on the dorsal tine of the movable cheliceral finger (a synapomorphy) and seven supernumerary denticles on the movable finger of the pedipalp (a symplesiomorphy). The ventral series of trichobothria on the pedipalp chela is compressed in



Figures 20–21. Right hemispermatophores of *Uroctonus* and *Vaejovis lindsayi*, figured from external view. Figure 20. *Uroctonus mordax mordax* from Mount Diablo, Contra Costa County, California. Figure 21. *Vaejovis lindsayi* from La Laguna, Sierra de la Laguna, Baja California Sur, Mexico.

these two species, with the distance between trichobothria Vt and Vst usually equaling less than two-thirds the distance between Vb and Vsb. The San Joaquin Valley, which lies between the known ranges of these two species, and a possible association of *U. sequoia* with caves and limestone outcrops, suggest that both geographical and ecological isolation have played a role in their speciation.

The sister species *U. giulianii* and *U. huachuca* are distributed to the east of the Sierra Nevada crest. Both have two subdistal teeth (rarely one) on the dorsal tine of the movable cheliceral finger (a symplesiomorphy) and have six supernumerary denticles on the movable finger of the pedipalp (a synapomorphy). The ventral series of trichobothria on the pedipalp chela is not as compressed in these species as it is in the western species pair, and the distance between chelal trichobothria Vt and Vst usually equals more than two-thirds the distance between



Figures 22–29. Representative hemispermatothores of the *minimus* group of *Vaejovis*. The external view of the right hemispermatothore is figured. Figure 22. *Vaejovis minimus minimus* from San Clemente Island, California. Figure 23. *Vaejovis rufulus* from Punta Banda, Baja California Norte, Mexico. Figure 24. *Vaejovis andreas* from Mount Palomar, San Diego County, California. Figure 25. *Vaejovis montcazieri* from Mission San Borja, Baja California Norte, Mexico. Figure 26. *Vaejovis bogerti* from Whitewater Canyon, Riverside County, California. Figure 27. *Vaejovis angelenus* from the Santa Monica Mountains, Los Angeles County, California. Figure 28. *Vaejovis iviei* from Mountain Millhouse, Napa County California. Figure 29. *Vaejovis glimmei* from Intersection of Cache and Davis Creeks, Lake County California.

Vb and Vsb. These two species appear to be montane relicts, with *U. giulianii* now restricted to the Inyo Mountains, White Mountains and eastern Sierra Nevada of California, and *U. huachuca* restricted to the Huachuca Mountains and Santa Rita Mountains of Arizona.

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